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EXAMINER	
DO, CHAT C	

ART UNIT	PAPER NUMBER
2124	

DATE MAILED: 05/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/507,521	Applicant(s) XIE ET AL.	
	Examiner Chat C. Do	Art Unit 2124	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2,3,5-11,13-17,19-25 and 27-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-3, 5-11, 13-17, 19-25, and 27-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This communication is responsive to Amendment F, filed 03/23/2004.

2. Claims 2-3, 5-11, 13-17, 19-25, and 27-37 are pending in this application. Claims 31 and 15 are independent claims. In the Amendment F, claims 36-37 are newly added. This action is made final.

Drawings

3. The drawings for Figures 3-4 were received on 03/23/2004. These drawings are accepted.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 2-3, 5-11, 13-17, 19-25, and 27-37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 31, the limitation "a mantissa region" in line 3 is unclear whether a mantissa region is a mantissa value of intended "point" x wherein $x = m * 2^e$ or a mantissa region is a region of natural logarithm function. For examination purposes, the examiner considers the limitation "a mantissa region" as a bounded region in a natural logarithm function. In addition, it is mis-descriptive by the limitation "wherein log(x) is

a function of a distance between the reference point a_i and the binary mantissa m" in line 12 because variable "x" is a single value of log of x as clearly cited in the claim line 10 (e.g. a value of log(x)...). For examination purposes, the examiner disregards the limitation. Claim 15 has the same problem as cited above.

Thus, claims 2-3, 5-11, 13-14, 16-17, 19-25, 27-30, and 32-37 are also rejected for being dependent on the rejected based claims 15 and 31.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 2-3, 7, 15-17, 21, 31, and 36-37 are rejected under 35 U.S.C. 103(a) as being obvious over Smith (U.S. 5,570,310) in view of Watson (U.S. 5,629,780).

Re claims 15, 31, and 36-37, Smith discloses a method in Figure 3 for computing (equation 10) for a natural logarithm function. The method comprises the following steps: partitioning of mantissa (col. 3 lines 65-67 and col. 4 lines 1-5 where i is the index of that sub-region as described in equation 13) between 1 and 2 into N equally spaced sub-regions, precomputing a reference point ai (col. 4 lines 17-18) of each of N equally spaced sub-regions where i = 0 to N-1, selecting N sufficiently large (col. 4 lines 1-10) so that the first degree polynomial in computation of log(m) within a preselected degree of accuracy, and computing (abstract) a value of log(x) for binary floating point

representation of x stored in a memory of a computing device. Smith does not disclose the precomputing point ai is the centerpoint of each of the sub-region. Smith does not discloses the computation of approximation of log(x) using first degree polynomial in m and the computation of log(x) is used to generate an image. However, Watson discloses a method of determining a value using a mid-point within a region for minimizing the error (col. 10 lines 30-35) and the computation is used to generate an image. In addition, it is well known in the art to use Taylor series to approximate a value. In order to minimize the computation process, the approximation of log(m) using Taylor series is utilizing the first degree polynomial of the Taylor series. Therefore, it would have been obvious to a person having ordinary skill in the art to use first order Taylor series to approximate the log(m) function, using the mid-point ai as the preference point, and the computation is used to generate an image as seen in Watson's invention into Smith's invention because it would enable to reduce the computation time and the region error.

Re claims 2-3, 7, 16-17, and 21, Smith discloses the method in Figure 3 for computing a natural logarithm function wherein the input number x (col. 1 lines 58-65) has a binary exponent in addition to the binary mantissa m. Smith discloses the steps of computing a value of log(x) by partitioning a mantissa m of binary representation of x in a memory (220 and 260) and precomputed value of log(ai) (280). Smith does not directly disclose that the Δx is computed from mantissa m to reference mid-point ai and the computation of log(x) using a polynomial of first degree in m. However, Watson discloses a method of determining a value using a mid-point within a region for minimizing error (col. 10 lines 30-35). In addition, it is well known in the art to use

Taylor series to approximate a value. The equation in claim 3 is the first order approximation of log(m) using Taylor series where log(m) = log(ai) + Δx/ai. Therefore, it would have been obvious to a person having ordinary skill in the art to use first order Taylor series to approximate the log(m) function and using the mid-point ai as the preference point because it would reduce the computation time and the region error.

8. Claims 8-11, 22-25, and 29-30 are rejected under 35 U.S.C. 103(a) as being obvious over Smith (U.S. 5,570,310) in view of Watson (U.S. 5,629,780), as applied to claims 15 and 31, in further view of Wallschlaeger (U.S. 5,345,381).

Re claims 8-9, 22-23, and 29-30, Smith in view of Watson discloses the above method for computing a natural logarithm function. Smith in view of Watson does not disclose the above method can be utilized in a computed tomography scanner as in image reconstructor for generating an image of an object from acquired projection data of the object. However, Wallschlaeger discloses the use of logarithm function (col. 1 lines 35-40) in a computed tomography scanner (Figure 1) as in image reconstructor (col. 1 lines 25-35) for generating an image of an object by manipulating the intensity values (Figure 3). Therefore, it would have been obvious application o a person having ordinary skill in the art to use the method of logarithm function in tomography scanner as in image reconstructor for generating an image of an scanned object as seen in Wallschlaeger's invention into Smith in view of Watson's invention because the Smith in view of Watson's logarithm function method would enable to yield faster results and less error.

Re claims 10-11 and 24-25, Smith in view of Wallschlaeger discloses the method in for computing a natural logarithm function in tomography scanner wherein the input number x (col. 1 lines 58-65) has a binary exponent in addition to the binary mantissa m. Smith in view of Wallschlaeger discloses the steps of computing a value of log(x) by partitioning a mantissa m of binary representation of x in a memory (220 and 260) and precomputed value of log(ai) (280). Smith in view of Wallschlaeger does not directly disclose that the Δx is computed from mantissa m to reference mid-point ai and the computation of log(x) using a polynomial of first degree in m. However, Watson discloses a method of determining a value using a mid-point within a region for minimizing error (col. 10 lines 30-35). In addition, it is well known in the art to use Taylor series to approximate a value. The equation in claim 3 is the first order approximation of log(m) using Taylor series. Therefore, it would have been obvious to a person having ordinary skill in the art to use first order Taylor series to approximate the log(m) function and using the mid-point ai as the preference point as seen in Watson' invention into Smith in view of Wallschlaeger's invention because it would enable to reduce the computation time and the region error.

Allowable Subject Matter

9. Claims 5-6, 13-14, 19-20, 27-28, and 32-35 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Response to Arguments

10. Applicant's arguments filed 03/23/2004 have been fully considered but they are not persuasive.

a. The applicant argues in pages 20-26 for all claims that neither Smith nor Watson or none of Smith Watson, and Wallschlaeger, considered alone or in combination, describe or suggest:

i. a computing device including a memory in which binary floating point representations of particular numbers are stored,

ii. partition a mantissa region between 1 and 2 into N equally spaced,

iii. a first degree polynomial in m computes log(m) within a preselected degree of accuracy for any m within the sub-region,

iv. compute a value of log(x), and

v. generate an image by using the computed value of log(x).

The examiner respectfully submits that all the cited arguments above by applicant are clearly rejected in general in the previous action and above under U.S.C 103. The applicant does not clearly point-out particular limitation(s) that the cited references fail to meet instead citing all the limitations in the independent claims. However, Smith in combined with Watson suggest a logarithm function device including the following limitations: a computing device (memory table in abstract line 10 in Smith) including a memory in which binary floating point

representations of particular numbers are stored (e.g. Figure 1 part 20 in Smith), partition a mantissa region between 1 and 2 into N equally spaced (e.g. col. 4 lines 1-4 in Smith), a first degree polynomial (e.g. equation in abstract in Smith wherein y = m) in m computes log(m) within a preselected degree of accuracy for any m within the sub-region, compute a value of log(x), and generate an image by using the computed value of log(x) (e.g. Figure 2 in combined with Watson).

b. The applicant argues in pages 20-26 for all claims that neither Smith nor Watson or none of Smith Watson, and Wallschlaeger, considered alone or in combination, describe or suggest a device configured to compute a value of log(x) for a binary floating point representation of x stored in memory utilizing the first degree polynomial in the binary mantissa m, where log(x) is a function of a distance between the reference point a_i and the binary mantissa m.

The examiner respectfully submits that Smith in view of Watson clearly describe or suggest a device configured to compute a value of log(x) for a binary floating point representation of x stored in memory utilizing the first degree polynomial in the binary mantissa m, where log(x) is a function of a distance between the reference point a_i and the binary mantissa m (e.g. equation in abstract line 10 and lines 14-16 in abstract).

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chat C. Do whose telephone number is (703) 305-5655. The examiner can normally be reached on M => F from 7:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaki Kakali can be reached on (703) 305-9662. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chat C. Do
Examiner
Art Unit 2124

April 22, 2004

TODD INGBERG
PRIMARY EXAMINER